Question:

A 5.0 x 10^4 kg space probe is traveling at a speed of 11,000 m/s through deep space. Retrorockets are fired along the line of motion to reduce the probe's speed. The retrorockets generate a force of 4.0 x 10^5 over a distance of 2500 km. What is the final speed of the probe?

a. –3.38 x 10^3 J
b. zero J
c. 3.38 x 10^3 J
d. –345 J
e. 345 J
f.

Solution :

Mass of the space probe, m = 5.0 x 10^4 kg
Speed of the space probe, u = 11,000 m/s
Force generated by retrorockets F = - 4.0 x 10^5 N (as it is acting opposite to the direction of probe)
Distance traveled S = 2500km = 2.5 x 10^6 m
Thus Using F = ma
or a = F/m = - 4.0 x 10^5 / 5.0 x 10^4 = - 8m/s^2
So using $v^2 – u^2 = 2as$
or $v^2 = 2as + u^2$
or v^2 = -2 * 8 * 2.5 x 10^6 + 11000^2
or v^2 = 81000000
or v = 9000 m/s is the final speed of the probe